

Original Article

Translation and cross-cultural adaptation of the extended version of the Nordic musculoskeletal questionnaire into Turkish

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Objectives: The purpose of this study was to translate and culturally adapt the Extended Version of the Nordic Musculoskeletal Questionnaire (NMQ-E) for use in Turkey. **Methods:** The cross-cultural adaptation was achieved by translating the items from the original version, with back-translation performed by independent mother-tongue translators, followed by committee review. Reliability (internal consistency and test-retest) was examined for 132 students (97 females, 35 males; mean±SD age: 19.91±1.24 years, mean±SD body mass index: 21.77±3.31 kg/m²) who completed the NMQ-E twice (with a 1 week interval). Construct validity was analyzed with the Cornell Musculoskeletal Discomfort questionnaire. Cronbach alpha was used to assess internal consistency. Intraclass correlation coefficient (ICC) and prevalence-adjusted bias-adjusted kappa (PABAK) were used to estimate the test-retest reliability. All of the statistical analyses were performed by using SPSS (version 22.0). **Results:** The Turkish version of the NMQ-E showed adequate internal consistency (Cronbach coefficient $\alpha=0.78$). The test-retest reliability was examined with PABAK and all items showed moderate to almost perfect reliability (PABAK=0.610-0.955), excellent ICC= 0.88 and good construct validity ($p<0.001$). **Conclusions:** The Turkish version of the NMQ-E has applicable psychometric properties, including good test-retest reliability, internal consistency and construct validity.

Keywords: Musculoskeletal Pain, Health Occupations Students, Extended Version of the Nordic Musculoskeletal Questionnaire

Introduction

Musculoskeletal discomfort is associated with inflammatory and degenerative conditions that affect muscles, tendons, ligaments, nerves, bones and joints. Aside from being common in the world population, these health conditions also comprise an economic burden to society, negatively affecting the quality of life^{1,2}.

Chronic musculoskeletal pain (MSP) affects a wide range

of people in the society ranging from the middle-aged working class to younger aged college students. Essentially in developing countries, one in the four people report to have MSP. This condition causes a reduction in the work productivity which would eventually leads to absence from work or school. Thus, this condition would bear negative consequences not only for the affected individuals but also for the society as well³⁻¹⁰. Given these impacts of MSP, a number of studies have been conducted to assess the factors contributing to MSP in laborers and office workers from various sectors^{4,8,9}. However, only a limited number of studies address MSP and its consequences in students of health sciences¹⁰⁻¹⁵.

In many epidemiological studies, it has been stated that musculoskeletal pain problems of office workers may be caused by long-term computer use and static sitting posture¹⁶⁻²⁰. In addition, it was shown that the most painful areas were the neck and back and shoulder regions^{19,20}. In particular, students of health professions, including nursing and physiotherapy students, may have static sitting posture problems such as long-term lesson session

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and computer use, as well as dynamic posture problems created by studies in various patient-related positions. The areas where the students feel pain are mostly mentioned as back, dorsal, neck, shoulder and hand²¹⁻²³. Throughout their education, health sciences (medicine, dentistry, physical therapy and rehabilitation, nursing etc.) students perform patient interventions in inpatient and outpatient settings. These interventions may include activities such as bending, stretching, lifting or pulling which may have a negative impact on body mechanics. Thus during the course of their education which comprise, students are predisposed to an increased risk of MSP because of their routine exposure to abnormal physical loading, ergonomic and postural problems. In line with the paradigm, a large number of graduate physiotherapists reported to experience MSP. Furthermore, a higher prevalence of low back pain was reported for undergraduate physiotherapy students compared with medical school students^{11,15}.

The key characteristic of epidemiology studies on MSP is collecting reliable data. In 1987, Kuorinka et al.²⁴ introduced the Standardized General Nordic Questionnaire in the literature as a screening tool to measure MSP. This tool is more commonly referred to as the Nordic Musculoskeletal Questionnaire (NMQ), which has been introduced as a more explanatory term by Dickinson et al.²⁵. The NMQ has been most widely used in occupational populations²⁶⁻³¹ rather than general populations³²⁻³⁴. Surprisingly, a literature chronology for the NMQ has underlined that the tool has been extensively used, albeit a rigorous reliability assessment is missing³⁵. After the introduction of the NMQ, the reliability studies of the tool were inconsistent²⁴. As such additional safety coefficients for the NMQ tool could only be presented 16 years after the introduction of the tool^{8,36}. Furthermore, the NMQ was frequently modified or adapted in these studies^{26,31,37-39}. The limitations of the original NMQ form to collect reliable data accounted for such frequent modifications and adaptations. Particularly, Dawson et al.³⁵ developed an extended version of NMQ to extract more data on the prevalence and impacts of MSP. This extended version of the Musculoskeletal Questionnaire (NMQ-E) was administered to health sciences students of nursing and was reported to be a valid and beneficial tool to be used in occupational and general populations³⁵. In addition, Pugh et al.⁴⁰ developed an online version of the questionnaire for graduate nurses working as health professionals and similarly reported that the online NMQ-E version was also a valid and reliable questionnaire for screening and assessment of MSP.

Self-report outcomes are important for clinical assessments and research. The use of self-report outcome measures in various languages facilitates collection of reliable data for the studies conducted in different countries by allowing comparisons of the outcomes. Notably, the assessment of cross-cultural competence ensures the measurement of the same parameters in different cultures and countries^{1,35}. The reliability study the Turkish version and cross-cultural adaptation of the NMQ was performed by Kahraman et al.¹ in 2015. However several studies⁴¹⁻⁴⁴ have

already used the NMQ-E version in Turkey, the reliability assessment and cross-cultural adaptation of the Turkish NMQ-E version has not been performed yet. Therefore, the aim of this study was to translate and cross-culturally adapt the NMQ-E for use in Turkey, and to determine the psychometric properties of this translated version.

Materials and methods

Translation and cross-cultural adaptation

The Research Ethics Committee of Acibadem University and Acibadem Healthcare Group has approved the study (reference no. 2016-7/3) after taking the permission of Anna P. Dawson by mail for the NMQ-E to be translated into Turkish and cross-culturally adapted. The adaptation procedure consisted of five stages as recommended by Beaton et al.⁴⁵ In the first stage the questionnaire was translated from English into Turkish by a translator blinded to the study and a physiotherapist aware of the study. Both persons speak English and Turkish as their mother tongue. Translations were completed independently from each other and the synthesis of translations took place in the second stage and the final draft of the translation was revised for any conceptual errors or inconsistencies by a person who possessed a good command of both English and Turkish. In the third stage the questionnaire was back-translated into English by two translators whose mother tongue was English and who also possessed a good command of Turkish. Both translators were blinded to the study and had no access to the original questionnaire. In the fourth stage an expert committee (a methodologist, a developer, a language professional, and the 4 translators) compared the questionnaire back-translated into English to the original version of the questionnaire and reviewed reports on the Turkish version of the questionnaire and finalized the questionnaire. The fifth stage consisted of preliminary testing.

Content validity

The method defined by Popham⁴⁶ was used to assess the validity of the content. The members of the Expert Committee determined whether each item of the NMQ-E was consistent with and relevant to the main construct of the questionnaire. Each expert rated each item by corresponding percentages and then the average percentage was calculated based on the sum of percentages given by each expert.

Preliminary testing

Students in master's degree and doctoral degree programs of the Health Sciences Institute of Acibadem University, who meet inclusion/exclusion criteria (n=30, 9 males, 21 females; the mean age, 27.4 years±2.3 years; body mass index=24.4±4.8 kg/m²) underwent preliminary testing. Each student completed the questionnaire and was allowed to have face-to-face interview with the physiotherapist who administered the questionnaire. Participants read the questions and evaluated every item for clarity. Any phrases

or words that the participants had difficulty understanding were noted by physiotherapists and participants were allowed to recommend various elements to delete/replace such phrases/words.

NMQ-E

The NMQ-E is completed by self-administration or face-to-face interview and provides reliable information on the onset, prevalence and outcomes of MSP in nine body regions (the neck, shoulder, upper back, elbow, wrist/hand, low back, hip/thigh, knee, ankle/foot). The NMQ-E interrogates ache, pain or discomfort experienced in the nine body parts to date, for the last 12 months, for the last four weeks and on the day of the administration, with binary choice questions (yes or no)^{35,40}. The finalized NMQ_E of Turkish version is included in the Appendix.

Construct validity

The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) was administered to each participant to assess construct validity. The CMDQ was developed by Hedge et al.^{47,48} to assess musculoskeletal disorders, at the Human factors and Ergonomics Laboratories. The questionnaire was translated into Turkish and the validation of the Turkish version was tested by Erdinç et al.⁴⁹. The questionnaire assesses pain in 20 individual regions under 3 chapters including frequency, severity and interference. The questionnaire interrogates the frequency and severity of MSP in various regions of the body and whether it interferes with work. Higher scores indicate and increased MSP. Responders are asked to mark the location of pain on a body pain diagram. Cornell Musculoskeletal Discomfort Questionnaire scores were calculated in two different ways^{49,50}:

- i. Scores were calculated by giving a relative value for the frequency, severity and interference with school related works. In the calculation of scores for each region, the frequency of experiencing pain was defined as 'never', '1-2 times/week', '3-4 times/week', 'at least once a day' or 'several times every day' and rated with weights of 0, 1.5, 3.5, 5 and 10 respectively.
- ii. The severity of discomfort was defined as 'Slightly uncomfortable', 'Moderately uncomfortable' and 'Very uncomfortable' and rated with weights of 1, 2 and 3, respectively. The inference with the ability to work was defined as 'Not at all', 'Slightly interfered' and 'Substantially interfered' and rated with weights of 1, 2 and 3, respectively.

Scores were obtained according to above definitions and varied between 0 to 90. "Discomfort Score" was calculated for each region assessed for pain. "Total Cornell Score" was obtained by summing all of the regional discomfort scores ranging from 0 to 990.

Participants

The sample size was calculated based on the intraclass coefficient correlation (ICC) calculated for internal validity, estimated 95% confidence interval and a width of 0.10. In

previous studies conducted by Kahraman et al.¹ and Dawson et al.³⁵, ICC values were 0.896 (would be rounded to 0.9) and 0.9, respectively and the estimated ICC value was considered as 0.9 and introduced into the formula. The sample size was calculated based on following formula developed by Knottnerus and Buntinx⁵¹ and found to be 144 participants.

$$N = [16 \times p \times (1-p)] / w^2$$

One hundred sixty-one physiotherapy and rehabilitation students attending Health Sciences Faculty of Acibadem Mehmet Ali Aydinlar University were included in the study on a voluntary basis. Participants had no severe chronic systemic or psychological diseases or any serious musculoskeletal disease (fibromyalgia, inflammatory rheumatic diseases, trauma and surgery involving musculoskeletal system) within six months before their participation in the study and each participant signed an informed consent form. The study was performed between September 2018 and March 2019. Participants were administered both NMQ-E and CMDQ and they were asked to complete these questionnaires in the order of the administration. One week later, they were asked to complete the NMQ-E once more. The study was conducted in 132 students who fully completed the entire questionnaires.

Reliability

Reliability is used to refer to internal consistency (homogeneity) and test-retest reliability (repeatability). A total of 132 participants were asked to complete the NMQ-E twice with one week interval to assess test-retest reliability. This time interval was considered to be enough to prevent the participant from remembering changes in their responses^{1,35}.

Statistical analysis

Categorical variables were given as frequency (n) and percentage (%), while continuous characteristics were summarized as "mean±SD". Group comparisons were conducted by the Mann-Whitney U test because all data were departed from normal approximation which was assessed by the Kolmogorov-Smirnov test. Internal consistency was assessed by using Cronbach's alpha coefficients (excellent, >80; adequate, 0.70-0.79; and inadequate, <70)^{52,53}. Test-retest reliability was analyzed by intraclass correlation coefficient (ICC, r=0.81-1.0, excellent; 0.61-0.80, very good; 0.41-0.60, good; 0.21-0.40, fair; and 0.00-0.20, poor)^{54,55} and prevalence-adjusted bias-adjusted kappa (PABAK) was calculated using the equation given below:

$$PABAK = 2p_o - 1$$

Wherein p_o refers to agreement ratio. PABAK measurements can account for the prevalence and bias and thus PABAK is considered to provide a better agreement estimate than Kappa alone⁴⁹. PABAK values was categorized to refer agreement levels as follows: 0.01-0.2, slight; 0.21-0.4, fair; 0.41-0.6, moderate; 0.61-0.8, substantial; and 0.81-1.0, perfect^{54,56}. All of the statistical analyses were performed by using SPSS (version 22.0) or Microsoft Excel 2010 (Microsoft, Corp, Redmond, WA).

Table 1. Participant musculoskeletal symptom prevalences and results of NMQ-E parameters.

Parts of body	Have you <u>ever</u> had trouble (ache, pain or discomfort) in: (Percentage %)	At the time of initial onset of the trouble, what was your age? (mean±SD years)	Have you ever been hospitalised because of the trouble? (Percentage %)	Have you ever had to change jobs or duties (even temporarily) because of the trouble? (Percentage %)	Have you had trouble (ache, pain or discomfort) at anytime during the <u>last 12 months</u> ? (Percentage %)	Have you had trouble (ache, pain or discomfort) at anytime during the <u>last months (4 weeks)</u> ? (Percentage %)	Have you had trouble (ache, pain or discomfort) <u>today</u> ? (Percentage %)	During the <u>last 12 months</u> have you at anytime:			
								Been prevented from doing your normal work (at home or away from home) because of trouble? (Percentage %)	Seen a doctor, physiotherapist or other such person because of trouble? (Percentage %)	Taken medication because of trouble? (Percentage %)	Taken sick leave from work/studies because of trouble? (Percentage %)
Neck	73%	16.48±2.90	4%	20%	59%	53%	25%	22%	10%	14%	8%
Shoulders	48%	16.13±2.39	10%	12%	38%	31%	14%	14%	8%	8%	3%
Upper Back	59%	16.82±1.90	1%	14%	44%	42%	20%	18%	8%	10%	5%
Elbows	12%	14.75±3.68	0%	3%	10%	6%	1%	2%	0%	2%	0%
Wrists/Hands	26%	17.00±3.06	3%	7%	16%	15%	8%	8%	3%	4%	2%
Low Back	68%	15.92±2.48	6%	21%	53%	51%	15%	18%	15%	16%	8%
Hips/Thighs	30%	16.83±2.40	3%	11%	20%	17%	8%	8%	5%	5%	5%
Knees	48%	16.33±3.14	5%	16%	28%	26%	8%	18%	8%	11%	6%
Ankles/Feet	28%	16.92±2.75	2%	8%	20%	12%	5%	5%	5%	5%	3%

Results

Content validity and preliminary testing

Based on the decision of the experts of the committee, the translation of the word “overlap” was changed to a word which was considered to be more understandable for the society (the word “çakışma” was changed into “birbiriyle örtüşme”). Further because a Bachelor in Science (BSc) program of chiropractic is not available in Turkey and not recognized by the society, the chiropractor profession group was excluded from the questionnaire. Generally, physiotherapists administer chiropractic treatment after taking courses after completing BSc degrees or attending postgraduate programs. After finalizing the questionnaire, it was assessed by every expert in the committee and all of its components were found to be consistent with the main construct. Therefore, the content validity was considered to be 100%. No amendments to the items were recommended in preliminary testing.

Participants

One hundred sixty-three students were recruited to our study on a voluntary basis. A student with bipolar disorder and a student who had a history of recent scoliosis surgery were excluded from the study. One hundred sixty-one physiotherapy and rehabilitation students who met the inclusion criteria were asked to complete the questionnaire on their own. 29 out of 161 students were excluded from the study due to missing demographic information in the questionnaire form or for not showing up in the retest (school absence or withdrawal from the study). Among the remaining 132 students (97 females, 35 males; mean±SD age: 19.91±1.24 years, mean±SD body mass index: 21.77±3.31 kg/m²), 23% (n: 30) were smokers and 13% (n: 17) reported social drinking. Among 3 students (2%) who had a mild systemic disease, 2 of them was reported to have insulin resistance and 1 to have hypothyroidism. Clinicians were asked to define these conditions as mild or severe. Based on the clinician’s decision, they were allowed to participate in the study as their doctors reported mild conditions.

Table 2. Comparison of the CMDQ between the participants with vs. without MSP during the last months (4 weeks) in NMQ-E?

Anatomical region	Yes		No		p value
	Median	Range	Median	Range	
Neck	15	135	0	105	P<0.001
Shoulders	6	225	0	65	P<0.001
Upper Back	15	135	0	35	P<0.001
Elbows	6	15	0	40	P<0.01
Wrists/Hands	12.5	175	0	105	P<0.001
Low Back	14	315	0	105	P<0.001
Hips/Thighs	9.5	90	0	20	P<0.001
Knees	14	155	0	40	P<0.001
Ankles/Feet	11,5	615	0	90	P<0.001

Table 3. Prevalence-adjusted bias-adjusted kappa (PABAK) agreement for each answer in the questionnaire.

Anatomical region	Have you had trouble (ache, pain or discomfort) at anytime during the last 12 months?			Have you had trouble (ache, pain or discomfort) at anytime during the last months (4 weeks)?			During the last 12 months have you at anytime: Been prevented from doing your normal work (at home or away from home) because of trouble?		
	PABAK	Prevalence	Bias	PABAK	Prevalence	Bias	PABAK	Prevalence	Bias
Neck	0,712 ^b	-0,205	0,023	0,667 ^b	-0,045	-0,015	0,803 ^a	0,538	0,023
Shoulders	0,697 ^b	0,258	-0,015	0,788 ^b	0,364	0,015	0,833 ^a	0,689	0,023
Upper Back	0,610 ^b	0,136	-0,015	0,682 ^b	0,189	-0,023	0,727 ^b	0,682	-0,045
Elbows	0,955 ^a	0,795	0,008	0,894 ^a	0,826	0,053	0,924 ^a	0,962	0,008
Wrists/Hands	0,864 ^a	0,720	-0,038	0,864 ^a	0,735	-0,038	0,909 ^a	0,833	0,000
Low Back	0,742 ^b	-0,114	0,053	0,712 ^b	-0,053	0,038	0,803 ^a	0,598	0,038
Hips/Thighs	0,803 ^a	0,583	0,023	0,818 ^a	0,652	0,015	0,879 ^a	0,818	0,015
Knees	0,894 ^a	0,417	0,023	0,818 ^a	0,500	-0,015	0,803 ^a	0,689	-0,053
Ankles/Feet	0,788 ^b	0,606	-0,015	0,803 ^a	0,689	0,068	0,742 ^b	0,826	0,083

^aAlmost perfect agreement. ^bSubstantial agreement.

Participant musculoskeletal symptom prevalences and results of NMQ-E parameters are listed in Table 1.

Construct validity

The data of participants were analyzed to examine the construct validity between NMQ-E and CMDQ. Except from the elbow section, significant differences were noted for all of the body parts between the participants with vs. without MSP in the all parts of body ($p<0.001$, Table 2). The CMDQ form does not include any section dedicated to the elbows as an anatomic region; instead, it includes a section for pain in the lower arm and pain in the upper arm. Therefore, pain scoring was analyzed by adding the pain scores from the lower arms and upper arms and a statistical significance was detected ($p<0.01$, Table 2). Overall, the construct validity results are shown in Table 2.

Reliability

The Turkish version of the NMQ-E showed adequate internal consistency (Cronbach α coefficient=0.78) and excellent test-retest reliability (intraclass correlation coefficient (ICC)=0.88). Furthermore, when PABAK was used to assess the retest reliability, PABAK coefficients ranged from 0.61 to 0.955 (0.61-0.8, substantial; and 0.81-1.0, perfect level). The test-retest reliability results are shown in Table 3.

Discussion

In this study we aimed to translate, transculturally adapt, and determine the psychometric properties of the Turkish version of the NMQ-E. For these aims, the validity and reliability of the translated form were found to be acceptable. As such the Turkish version of the NMQ-E showed adequate internal

consistency and a perfect intraclass correlation coefficient. Further, test-retest reliability which was assessed by PABAK revealed a high to almost perfect reliability for all of the items. Turkish version of the NMQ-E was also shown to have a good construct validity. Hence, overall we report that the Turkish version of the NMQ-E has appropriate psychometric properties, including good test-retest reliability, internal consistency and construct validity

The NMQ allows comparisons of musculoskeletal problems in different body parts for use in epidemiological studies. Essentially NMQ measures musculoskeletal pain in 9 distinct body regions which may lead to disturbance of the activities of daily living. This tool was previously reported to assess work-related musculoskeletal pain in large sample sizes^{25,57}. NMQ has been translated into Brazilian Portuguese⁵⁸, Greek⁵⁹, European Portuguese⁶⁰, Chinese⁶¹, Turkish¹ and Persian⁶². In these translation and adaptation studies, the kappa coefficients varied in the range of 0.63-1.0. Particularly, the study of Mesquita et al.⁶⁰ revealed an excellent internal consistency, with a Kuder-Richarson coefficient of 0.855. Paralel to this finding, Kahraman et al.¹ qualified the Turkish version of the NMQ as excellent with a Cronbach's alpha of 0.896. Moreover the assessment of test-retest reliability using PABAK revealed a moderate to almost perfect reliability (PABAK=0.57-0.90) for all of the items¹. In all of these studies, the NMQ has been found to be reliable and valid and was reported to be an appropriate tool to assess musculoskeletal pain. However, in studies with non-adapted version of the NMQ, the questionnaire has been frequently amended and modified for specific use in relevant groups^{26,31-34}. As the limited ability of the original form to collect data was accepted as the underlying cause of such amendments and adaptations, in 2009, Dawson et al.³⁵ developed an extended version of the NMQ to create more data on the prevalence and impacts of MSP. Dawson et al.³⁵ reported that their NMQ-E would provide data reliable enough to suggest that this version might be used as a screening tool able to reflect the prevalence and outcomes of musculoskeletal pain.

The proportion of observed agreement for NMQ-E has been found to be higher than the proportion described for the NMQ. The original version of the NMQ may collect minimal data on musculoskeletal pain and activity prevention. Therefore, Dawson et al.³⁵ considered the development of the NMQ-E important and suggested that the NMQ-E might be used in descriptive studies and longitudinal studies of disease outcomes to classify the intensity of pain. Further this tool can also be used as a self-assessment tool or may be administered during in personal interviews. Severe back pain is defined as pain necessitating treatment or sick leave while low back pain may be defined as non-severe in the absence of such conditions. The NMQ-E may facilitate to classify pain for purposes of longitudinal studies of disease outcomes. Pugh et al.⁴⁰ developed an online version of NMQ-E and administered to nurses. In line with our study, they found Cronbach's alpha values ranging between 0.81 and 0.92 and ICC values higher than 0.75. They suggested that the online

version might be also used in health professionals. As far as we know, the NMQ-E has been translated only into Persian language and the Persian version was culturally adapted¹. In that study conducted by Mokhtarinia et al.⁵⁷, 45 patients with musculoskeletal disorders were administered the questionnaire; the authors reported that the translation and localization of NMQ-E was easy and feasible. Furthermore, all of the items of the questionnaire were found to have acceptable face validity; the Intraclass Correlation Coefficient (ICC) was calculated as >0.7 and the Kappa coefficient varied from 0.78 to 1.00. Therefore, in line with our study the Persian version of the NMQ-E was reported to have an acceptable validity and test-retest reliability, to assess musculoskeletal disorders in Iranian patients⁵⁷.

In 1960, Cohen⁶³ developed kappa statistics only to be used in the assessment of categorical data that correct or adjust random agreement. Although it has been criticized to be highly dependent on the prevalence of the condition in the population, kappa has been widely used after its development and is still used. PABAK was developed to overcome the limitation of Kappa. When compared with Kappa, PABAK reflects the ideal situation and determine the prevalence of conditions and biases presented in the "real" world. PABAK is adjusted for the prevalence and bias; however, prevalence and bias indices are also checked with PABAK coefficients⁶⁴. In our study, bias indices have been very low while prevalence indices have been relatively higher. Therefore, test-retest reliability of this translated version of the questionnaire has been found to be high. In the study conducted by Kahraman et al.¹, PABAK results for the Turkish version of the NMQ were similar to those found in our study.

In our study the CMDQ was used to assess the construct validity. The CMDQ was chosen to assess the construct validity in our study because the CMDQ assessed the presence of pain in different anatomical regions in a similar way to the NMQ-E. The Turkish version of the CMDQ has been validated by Erdinç et al.⁴⁹ (Kappa coefficients=0.56 to 0.97). However we could not measure the construct convergent validity of CMDQ with the NMQ-E regions by using a correlation analysis due to 2-way answer options. Therefore, the results in participants with musculoskeletal problems and without musculoskeletal problems were compared to each other based on the CMDQ scores for matching regions. As a result, we determined that this translated questionnaire had good construct validity, as this translated questionnaire was found to be statistically significant in analyses performed for all anatomical regions.

The time interval between test and retest measurements is important in the assessment of test-retest reliability⁵⁷. In general, the interval between the first measurement and retest measurement should be short (3 to 7 days) when the condition is expected to change rapidly⁶⁵. However, Marx et al.⁶⁶ demonstrated that a test-retest interval ranging from 2 to 14 days might not affect reliability tests of health status assessment tools in clinically stable populations⁶⁷. Dawson et al.³⁵ used a time interval of 24 hours when developing the NMQ-E and reported that the time interval used in their study might be a potential limitation. Furthermore, they also

suggested that an assessment of the reliability of the NMQ-E after a longer time period of time (i.e. 7 to 14 days) might be beneficial to determine whether reliability estimates were decreased as the time interval between test and retest was increased. Pugh et al.⁴⁰ also used time intervals ranging from 4 to 7 days for the online version of NMQ-E with the assumption that the time interval might not affect the overall reliability of the questionnaire. To simulate previous studies, we chose 7 days as the test-retest interval which can be considered as one of the limitations of this study due to possibility of recall bias.

Most of the questionnaires in the literature have been developed in English and therefore it can be said that these questionnaires reflect more of the AngloSaxon culture. Although most of the questionnaires are used as standard in the literature, the correct use of these tools depends on their compatibility with different languages and cultures while preserving cultural equality^{67,68}. A strict adaptation process is required to avoid the potentially confusing distribution of questionnaires, and only translation is not sufficient. For this reason, intercultural adaptation ensures that the studies are carried out reliably between different countries⁶⁹. When planning the study, we aimed cultural adaptation of the NMQ-E questionnaire. Upon comprehensive inspection of all items of the questionnaire, we did not find any phrases that need to a cross-cultural translation except from “chiropractor and overlap”. Overall, all of the terms/phrases in the items already have a direct translation the Turkish language and more importantly widely recognized by the Turkish population. Furthermore, the expert committee has assessed and validated the cross-cultural adaptation of the current study.

The limitation of our study is that the questionnaire was administered to relatively a healthy population included only college students. However, we aimed at reducing this limitation by selecting students from the Department of Physical Therapy and Rehabilitation as this was a population that had previously reported musculoskeletal pain in association during their education^{11,15}. The rate of students experiencing pain was relatively high and one out two college students answered “yes” to the question of “Have you experienced any problem (pain, pain or discomfort)” for the neck and low back region. 40% of students reported pain in the upper back region. Therefore, we suggest that students from the Department of Physical Therapy and Rehabilitation should be encouraged more to use self-protection techniques during their education. Furthermore, future studies should be conducted among workers and patients and the reliability of the answers to NMQ-E should be checked against medical and workplace records, as suggested by Dawson et al.³⁵. It might be more appropriate to assess the content validity in this way. The reliability of the NMQ-E in general population should also be determined.

This study was conducted to investigate psychometric properties of the Turkish version of the NMQ-E. Overall, our results provided significant contributions to the current literature, reflecting that the Turkish Version of the NMQ-E

possess appropriate psychometric properties including a good test-retest reliability and construct validity. In conclusion, the NMQ-E Turkish version produces reliable data on the onset, prevalence and outcomes of musculoskeletal pain in an educated occupational cohort and may be used as a self-administered tool in epidemiological studies.

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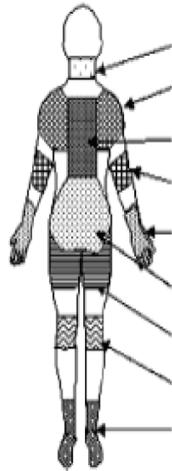
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Appendix

Turkish Version of NMQ-E.

GENİŞLETİLMİŞ NORDİC KAS İSKELET SİSTEMİ ANKETİ

Anketi nasıl cevaplarım?
Lütfen uygun olan kutucuğa bir çarpı (X) koyarak cevaplayınız. Her soru için sadece bir çarpı koyunuz. Vücudunuzun herhangi bir bölgesinde bir sorun yaşamamış olsanız dahi, her soruyu cevaplayınız. Lütfen, soruları soldan sağa olacak şekilde cevaplayınız, daha sonra aşağı doğru vücudun diğer bölgesine yönelik sorulara geçiniz. Bu resim vücudun bölgelerini göstermektedir. Sınırlar kesin bir şekilde belirlenmemiştir ve bazı bölümler birbiri ile örtüşmektedir. Vücudunuzun hangi bölgesinin etkilendiğine (eğer böyle bir bölge varsa) veya etkilenmiş olduğuna kendiniz karar vermelisiniz.



	Vücudunuzun bu bölgesinde hiç sorun yaşadınız mı? (sancı, ağrı, rahatsızlık)	Eğer yanıtınız "hayır" ise, bir sonraki vücut bölgesine geçin. Eğer yanıtınız "evet" ise lütfen devam edin	Sorun yaşamaya başladığınızda kaç yaşındaydınız?	Bu sorun yüzünden hiç hastaneye yatırıldınız mı?	Bu sorun yüzünden (kısa süreliğine bile olsa) hiç işinizi veya görevinizi değiştirmek zorunda kaldınız mı?	Son 12 ayda vücudunuzun bu bölgesinde hiç sorun yaşadınız mı? (sancı, ağrı, rahatsızlık)	Eğer yanıtınız "hayır" ise, bir sonraki vücut bölgesine geçin. Eğer yanıtınız "evet" ise lütfen devam edin.	Geçen ay (4 haftada) vücudunuzun bu bölgesinde hiç sorun yaşadınız mı? (sancı, ağrı, rahatsızlık)	Bugün vücudunuzun bu bölgesinde hiç sorun yaşadınız mı? (sancı, ağrı, rahatsızlık)	Geçtiğimiz son 12 ayın herhangi bir zamanında			
										Bu sorun (evde veya ev dışında) normal işlerinizi yapmanıza engel oldu mu?	Bu sorun yüzünden hiç bir doktora, fizyoterapiste vb. bir uzmana görüldünüz mü?	Bu sorun yüzünden ilaç aldınız mı?	Bu sorun yüzünden işten veya okuldan izin almak durumunda kaldınız mı?
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